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ABSTRACT

After less than a decade from its inception, the introduction of new information technology in Australian education has already undergone some identifiable stages. These range from the scattered development of innovative programs to the formulation of state and national policies, from the original introduction of microcomputers into schools to the more recent developments in telecommunication and satellite technology. This paper identifies and analyzes the processes whereby, in each stage of development, certain elements predominate over others. In particular, comparisons are drawn between the predominant and "neglected" agendas of large-scale developments in education, on one hand, and the innovation sector where the more advanced applications of the technology remain confined to few schools and few learners. Against this background, this paper outlines the political, policy, and pedagogical implications of such differential developments with a view to establishing policy and research agendas to redress the balance. (Author/TE)

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Information Technology in Education: the Neglected Agenda

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Summary:

After less than a decade from its inception, the introduction of the new information technology in education has already undergone some identifiable stages. These span from the scattered development of innovative programmes to the formulation of state and national policies, from the original introduction of microcomputers into schools to the more recent developments in telecommunication and satellite technology.

This paper identifies and analyses the processes whereby, in each stage, some elements become predominant over others, thus flexing the course originally intended towards different objectives and outcomes. In particular, comparisons between the "predominant" and "neglected" agendas are drawn within and between large scale developments in education and its innovation sector where the more advanced applications of the technology remain confined to few schools and few learners.

Against this background, the paper outlines the political, policy and pedagogical implications of such differential developments with a view to establishing policy and research agendas to redress the balance.

Introduction

At the beginning there were strong emotions. Some were positive and some negative. The microchip and its related technologies, commercialised on a large scale in the mid 70s, had soon had a profound impact on society. As its impact on the production and service sectors began reshaping them, improving productivity and increasing levels of unemployment, society at large started reacting strongly, at least at the level of emotions. What was being gained and by whom and at what cost and for whom; how far would computer technology impact on and affect society; what aspects of human life would be called into question; these were the questions asked ten years ago. The responses were not forthcoming then and are still asked today.

Many statements were made, in favour or against, but hard evidence was generally scarce. Ten years ago, rationalisations, productivity and retrenchement were the only realities one could contend with.

Education was slow to enter the debate and even slower to open its doors to the new technology. Experiments with the larger computers in the late 60s and early 70s had left memories which were not always happy or conclusive. CAI had been adopted unevenly in the system, less in primary than in secondary education, less in secondary than in colleges and universities. Its introduction had been by and large a matter of decision by individual educational establishments or small groups of educational establishments with little, if any, intervention at the government policy level, in any country.

Among the historical European examples that could be mentioned are Denmark, where computer-based experimentation started in primary and secondary education in the early 70s, to be discontinued in 1975 after a change in government and a new School Act. In Germany, the 70s saw a steady decline in government investment in this area, started in 1972 with a healthy injection of 52 million federal Marks matched by similar contributions from the Laender and virtually disappeared ten years later. In France the political will was more favourable to the technology. An experiment with 58 high schools started in 1972 did lead to a national policy for all schools in the early 80s (Gorny, 1982).

However limited, the experience with the technology was a real one in education and provided the foundations for the debates as well as the disputes. Because of what they knew, or believed they knew, from such pilot work, and because of the information emerging from the production and service sectors practitioners and policy makers in education, were able to take sides with some degree of credibility and conviction.

The enthusiasm and hostility they displayed helped set in motion a process which, by the late 70s and early 80s, introduced computer technology in education on the largest of scales. The new information technologies, heralded by some as the panacea for all ills in education and abhorred by others as the latest dehumanising tool developed by twisted minds, entered education on a national scale in Australia as well as overseas.

In 1987, almost a decade from its inception *as a large scale process*, the introduction of information technology in education has already undergone a number of clearly identifiable developmental stages.

In Australia, the first started in the early 80s with the declaration that the process was under the responsibility of government. The establishment of national and state policies for education, in most states, marked the point. This development has produced a multitude of microcomputer-based initiatives and programmes around the country.

The second started in the mid 80s, with the introduction of another form of information technology, "telematics" (computer and telecommunication- based educational activities) as an innovation and experimentation in education in some states. Although at a slower pace than the first, this development is also producing a variety of initiatives and programmes, currently spreading to all states and territories in Australia. The speed of this development is determined primarily by the high costs involved and by telecommunication policies, currently evolving.

The impact on education has already been of such amplitude that it has left a deep impression. The introduction of information technology in education is occurring at different speeds and following different modalities. The nature of both speed and modalities is drawing patterns which suggest clear reasons for satisfaction and hope as well as concern and doubts.

This paper aims at analysing these patterns and underlining the elements in it which are promising, even thrillingly so - the "predominant" agenda in education. It also aims at analysing the aspects that are less positive, even alarmingly so - the "neglected" agenda - and drawing some conclusions for possible future directions in policies and programmes in education. It does so by considering the emergence of differential patterns of development (Part I), the reasons why they formed and their impact on the delivery of the educational service (Part II). Finally, the paper outlines different policy strategies for the future (Part III).

Part I The emergence of differential patterns of development

Today's pattern is one of variations and differences. It is the contention of this paper that, if left to consolidate, the current pattern mapping out the introduction of information technology in education will produce a number of problems for education and its clients as well as for the economy.

Differences across technologies

Of the various forms of information technology, only one of them, microcomputers, has found its way into schools in large numbers. Other forms, such as the video disk or computer-based telecommunication applications are still marginal to education in most countries (Fasano, 1986, p.23) (Fasano et al, 1987, p.14).

Differences across countries

In times where the economy of each country is determined at the scale of the planet, and where so much of the economy depends on the application of information technology, there are differences across countries.

The differences exist across developing and developed countries. At a UNESCO Conference held in Stanford in March 1986, the international scene was as follows:

By June 1985, 86% of US school districts had acquired 1,275,000 microcomputers and were expected to acquire 4.9 million computers by 1990 (Carnoy et al., 1986, p. 16) . Assuming a total population of around 200 million people, these figures correspond to an estimated total 1,482,558 microcomputers in all districts, that is 7.4 microcomputers per 1,000 people in the country; this was expected to jump to 28.5 mcp per 1,000 people by 1990.

In France, computer courses in secondary education were made compulsory in 1985. This was followed up in 1986 with the last years of primary education (which correspond to the Australian Y3 and Y4). The "compulsion" gives an idea of the amount of equipment involved. The policy launched in 1983 aimed at 100,000 microcomputers by 1988. In early 1985, the objective was upgraded to 120,000 (i.e about 2 microcomputers per 1,000 people in the country) (Fasano, 1985, p.261).

At the other end of the scale, one finds countries such as Mexico or India which are still at the planning stage only (Carnoy at al., p.17).

The reference line in Australia is 775 microcomputers recorded in a representative sample of 1006 primary and secondary schools in 1986 (Fitzgerald et al., 1986, p13 and 21). Using the 1983 total number of primary and secondary schools (CSC, 1985, p.204), and assuming no major increase in their number by 1986, it can be estimated that in 1986 there were 7633 microcomputers in Australian schools, that is a ratio of 0.5 microcomputers per 1000 people in the country.

It is interesting to note that by 1986, two of the major computer producing nations, Germany and Japan were still persisting in their "low key" investments in school computers (Carnoy at al., 1986, p.17), thus continuing the policy options put forward in the early 80s which qualified Japan as the country with the slowest speed of introduction of computers in education amongst the OECD countries (Fasano, 1986, p.18-24).

Within countries differences

schools and tertiary institutions

State and national policies in the countries involved have been concerned only with schools. Developments in tertiary institutions has so far been left to the institutions themselves. (Fasano, 1986, p.24). This has produced a situation where tertiary institutions - currently under scrutiny for their perceived weak contribution to the revamping of the countries' economies - show the least coordination with government-driven economic developments.

equipment, software and teacher training

Although few official policy statements recognise it, different priorities have been introduced in education as to how to allocate scarce resources. In the large majority of countries, equipment has been given a high priority, with curriculum development (and software) being a second at a considerable distance and teacher training lagging farther still behind. In most countries software is produced mostly by teachers with debatable results as to their aggregated quality (Fasano, 1986, p. 35) (Carnoy at al, 1986, p.24). Only a handful of countries have determined to train the totality of their teaching force. In 1983, France and Sweeden started implememenTing such policies (Fasano, 1986, p.40). By 1986, however, and despite the massive investments, no more than 25% of the teaching force was reported as trained (Carnoy et al, 1986, p.24). In a recent Australian study of teachers in country areas, only one quarter of the schools surveyed reported that all their teachers were literate in "computers in the classroom". Furthermore, only 16% of the schools reported in service teacher training as the origin of their knowledge about computers (Fasano et al., 1987, p.9).

primary and secondary education

Marked differences exist within countries as to the distribution of computers across the various levels of schooling. A common feature is to have secondary schools better endowed than primary schools (Fasano, 1986, p. 95) (Fitzgerald et al, 1986) (Fasano et al, 1987, p.13) which, for developing countries means that most primary school children have no access at all to a computer (Carnoy et al. 1986, p.18)

poor schools, rich schools, boys and girls

For a time it was feared that computers would increase the gap between poor and rich schools, and between access granted to girls and boys, to the advantage of the latter. More recent evidence from the U.S. dispels the fears but only to a marginal extent. Computers are found in similar numbers in "poor" and in "rich" schools. Forthermore, across schools, there are no significant differences as to the use of computers by boys and girls.

However, the evidence also shows that "within a school, the courses for which computers are used by different social class groups may be very different. Further, the outside-of-school use (i.e. home and recreational) is different both by gender and social class" (Carnoy et al.1986, p.22).

urban schools and country schools

Very little systematic evidence is available on the comparison between city and country schools. An Australian study shows that country schools are not at a disadvantage with respect to hardware (Fitzgerald et al, 1986, p.18). Another Australian study suggests however that lack of differences might not be as laudable as it seems (Fasano et al, 1987, p.4 and p.80). State and national policies to introduce information technology in schools have by and large failed to aknowledge the specificity of country needs, such as isolation and limited choice of subjects, where the technology could make a substantional contribution. These problems, on the other hand, are central to the development of isolated pilot programmes for rural areas.

mainstream and innovative/experimental education

The combination of the implementation of national policies in times of scarce resources with the policies being reactive rather than proactive, has meant the emergence of a dual technological market in education. Large scale education is working with slightly obsolete (one or two generations old) microcomputer technology while updated technology is present almost exclusively in isolated instances of educational experimentation and piloting which are often not followed up (Fasano, 1987).

Action and reflection

Against a background of mushrooming activities and programmes, Australia shares with other countries the scarcity of investments in two areas. One is the establishment of "states of the art" initiatives, which by pooling and structuring data on ongoing activities could create a critical mass of information to use as a base for more efficient targetting of further investment in research, programme development and policy. Equally importantly, much less is known in Australia and overseas on costs as it is on benefits on the introduction of information technology in education. More specifically, not enough of in-depth evaluation studies are carried out on what works (and at what costs and for whom), what is detrimental to the learner and what makes no difference (and at what costs and for whom). The compounded result of the above priorities is a situation which is action rich but reflection poor in education.

It is the claim of this paper that these differences in developments are not at random, nor are they innocent. To understand their relationship to what education is supposed to be doing when introducing information technology into the system, it is suggested that we look closely at the reasons why these patterns have emerged.

Part II Determinants and motivations

The official reasons given to support the introduction of computers in education can be classified in three separate groups (Fasano, 1986, p.10-19) (Carnoy et al., 1986).

The need of the economy has been a prominent argument. It called for improved performance in the production sector. In that, it claimed for new computer-related skills to be taught to the young, both in specialised discipline areas, such as in computer sciences, and in non-specialised ones, such as virtually every trade and profession where the technology is present.

This argument also called for improved performance in the service sector, where education is located. In that it claimed for cost/effectiveness and organisational and functional criteria to be introduced in education.

The need of society has been an equally conspicuous argument. Irrespective of being employed, the young are called upon to live and function effectively in a society permeated by the new technology. Therefore, they need to know about technology. That knowledge has to be acquired during the educational years.

The pedagogical argument has also been strong. Learning with computers, or about some aspect of computing, such as learning to program, has been claimed to have beneficial effects on the quality of the mind, especially on reasoning and thinking skills.

These arguments have been instrumental in introducing computer technology in education. The economic argument has been central to introducing computers in vocational lines, that is to the expansion of computer courses and the introduction of computer studies in specialised courses such as administrative and business studies.

The "user" version of the economic argument, i.e. knowing about computers facilitates employment, has combined with the "society" argument to encourage parents and "school friends" to raise funds for computers in schools.

The pedagogical argument has been central to most research, experimental and pilot work in education. All three are present in state and national policy formulations, where they are tied together by the conceptual glue of "equity" issues.

What are the reasons why such generally clear arguments have resulted in the disparate developments outlined before? Why, of all the information technologies, have only microcomputers entered education on a large scale? Why has tertiary education not, as yet, been targetted alongside schools in state and national policies? Why is there such a scarcity of quality software in education? Why has so little been done to train teachers?

Why are there such pronounced differences between secondary and primary schools (a ratio of 5 microcomputers to 1 has been recorded in a national Australian study (Fitzgerald et al, 1986) and confirmed by another independent study of rural schools (Fasano et al, 1987)) How could schools counteract or make up for the differential impact of the home over the learning of the students?

Why haven't the experiments and innovations in education produced more "transferable" knowledge for education as a whole? Why hasn't the experience and understanding gained through them been formalised in guidelines for all schools?

Why, after almost a decade of introducing computers, is education still blamed for not having "produced the goods"?

All these "whys" are items on the neglected agenda. They need answers as a matter of urgency.

The urgency comes from the costs of pursuing the developments. These are high indeed in times of economic "rationalisation" and would be even higher if "equity" of developments was set as an objective.

The urgency also comes, in Australia, from the recent change of political climate which is tending towards establishing a tighter link between educational and economic objectives, with - and this is the important point - a disproportiately larger share of responsibility and accountability assigned to education than to "the economy" in "producing the goods".

Studies of the implementation of policies and programmes in Australia as well as overseas suggest that, whatever the specificity of the answers, they will most likely be related to general list hereafter.

Lack of long term and realistic planning and committment on the part of government.
Very few of the governments taking responsibility for these new educational developments at the policy level, realised how long and costly it would be (Fasano, 1986, p.26). In particular, they did not realise how unrealistic it was to expect that these developments could be financed from within the educational budget. Very few governments so far have designed policies to introduce technology in education on the macroscale on the basis of some form of association between education and other government agencies, such as those related to industrial and technological development.

The few exceptions that can be mentioned include the Department of Industry in the U.K. and their French counterpart, which both participated - visibly and invisibly - in the launching and financing of the first national programmes of computers in education in their respective countries in the early 80s.

Lack of specific and substantiated directions from the economy.
When analysing the demands of the economy on education as reported, for instance by the Business Council of Australia (Sinclair, K. 1986,) (Business Council of Australia, 1987), or the more recent statements by the Federal Ministers of Industry, Technology and Commerce (CDIC, 1987) and of Employment, Education and Training (reported in The Australian, 23 Sept.1987) one finds it difficult to disentangle what are the manpower requests from what are in fact generalised complaints about what is learned in schools.

The lingering degree of ambiguity is about:

(i) *numbers* - what education needs to do in quantitative terms, i.e. in terms of increasing the production of certificate holders and graduates in established educational lines;

(ii) *content* - what education needs to do in qualitative terms, i.e. in terms of introducing new certificates and degrees in new study or trade areas or changing the curriculum of established educational lines;

(iii) *brainpower* - what education needs to do to increase the total brainpower in the country;

(iv) *values and attitudes* - what education needs to do in terms of values and norms of behaviour as different from skills and knowledge;

(v) *rationalisation of services* - what education needs to do to improve its own efficiency as part of the service sector.

Each of the above categories of demands calls for a different policy response in education. They range from "capacity" policies to policies aiming at changing "content" and "structures" within as well as across established institutional sectors in education.

Evidence is available suggesting that the ambiguity relates strongly to the economy's lack of clarity about itself. This seems to be as true in the high-tech sector of the economy as it is in other sectors. In the computer-related areas, some authors have found it useful to categorise the kinds of skills needed by differentiating among three groups (Jallade, 1984):

group 1 - the "high level"specialists, expected to remain small in numbers, who produce the technology, both hardware and software;

group 2 - the "appliers", who will have to modify existing technology to suit their specific needs, who form a larger group and are characterised by a "double qualification" where computer-related skills are added to those of established trades and professions, and

group 3 - the "users", a nebulous group, which could be as large as society, called to use the technologies in a variety of situations.

Recent evidence from the U.S. suggests some trends with regard to the size of the first two groups. "The growth of the electronic industry - an important source of computer-related jobs - has been and could continue to be significant in some countries.....but it does not seem to be creating the massive increase in such jobs often promised by the information society visionaries. Rather, the growth of microelectronic production creates many new jobs, often with new skills, but skills more likely to be associated with highly accurate manual work or with quality control, not computer related technical skills" (Carnoy et al, 1986, p.39-43).

As for the computer-related skills in other industries, which would suggest the need for some form of upgraded "computer literacy" or "double qualification", the same author reports, first, a shift from "equating simple computer skills with math and reading skills to one which focuses on building a foundation for changing job skills" and, second, that "the tendency towards increasingly user-friendly software could make such computer literacy training even less relevant in the future than it is now". Specifically "....no large burden will be imposed on the educational system to prepare students for work in the computer age. The burden on the educational system will be centred on a few (trade and professional) sectors (only)"(Goldstein and Fraser, 1985, p.38)

If this kind of information suggests caution in adopting uncritically the quantitative and qualitative targets set for eduction by government and industry, other evidence suggests that, besides the need for increased numbers in specific trade and professional areas, the bulk of the economic demands on education could in fact boil down to just a moral discourse.

Drawing on extensive studies of small and large enterprises in Australia, Jane Marceau has highlighted some aspects of this sector of the economy which bear important implications for education which are somewhat at variance with the official discourse (Marceau, 1987). One such aspect is the paramount - so far - role of in-house on-the-job training or (in most cases) just experience for skill building and career in most of these enterprises. Another is the importance of attitudinal and moral characteristics for first job applicants. Yet another is the absence of degree holders in

small enterprises and their scarcity in the larger ones. An important finding is also the loose targetting of employment strategies to specific educational qualifications, with only a minority of large enterprises following a systematic and selective search for their new entrants.

Finally, the author points to the relationship between such peculiar use of educational credentials by the enterprises and their own ongoing process of adaptation to the new technology-driven economic order. It is the author's opinion that the demands on education will become clearer and less ambiguous only when the production sector of the economy has clarified its own internal oganisation and functioning, because "organisational choices will have a profound effect on the degree to which the technologies will raise or lower educational requirements for jobs as the relationship linking education to technology and productivity is highly dependent on the internal organisation of the productive enterprise. In Australia the bases for that organisation still remain to be negotiated".

The slow growth of evidence for the pedagogical argument

The promise of cognitive gains have been central to the push from educational lobbies. Some ten years of experimentation and classroom trials have produced a body of evidence which is, however, still patchy. Not that supporting evidence has not been forthcoming. But the coverage and depth has not been such, as yet, to allow valid generalisations to be drawn. In particular, conclusive evidence from routine classroom practice is still wanted in a number of areas, due mainly to lack of research and /or evaluation studies being carried out in large enough numbers.

An international survey of CAI applications summarizes the evidence on what correlates with educational achievement (Carnoy et al, 1986, p. 51-55):

(i) *educational level* - CAI applications at lower educational levels have proven relatively more effective than those at higher levels; this has been found both across educational levels (primary schools applications are more effective than high school or college ones) and within the primary level (CAI in lower primary grades are more effective than those in later years)

(ii) *student ability* - The preponderance of the evidence from CAI studies suggests that, at both the primary and secondary school levels, low ability students experience greater achievement gains than average or high-ability students. Some European studies, while confirming the general trends suggest caution about overgeneralising: not all low ability students gain systematically from CAI (Fasano, 1986, p. 57).

(iii) *course content* - at lower educational levels CAI applications in precisely defined domains such as mathematics appears most successful; in contrast, at the college level applications in more open ended fields of study are most effective.

(iv) *personality variables* - while studies of computer based instructions have reported only modest effects on academic attitudes, most studies report a net improvement of self-efficacy and self-confidence, especially among girls and low achievement students.

(v) *technology improvements* - there is a strong presumption that technology improvements result in more effective applications

The conclusions above support the view that computers have good potential in the tutoring of learning, although their use needs to be selective and their targetting careful.

When it comes to using computers as creative rather than strictly tutorial tools, the results are more mixed. The effects of programming on problem solving skills, namely through LOGO paradigms has led to mixed results across studies, depending on the specific cognitive area under study. Computer games and curriculum for problem-solving are burgeoning areas in education and seem to be promising. Time and research investments will tell (Carnoy et al, 1986, p. 54-56).

In contrast with the research and experimentation reported above, ordinary classrooms look much less adventurous. Discovery learning and problem solving takes only 17% of the computer time for K-6 pupils in the U.S. the rest being taken up by drill and practice (56%) and programming or word processing (a combined 21%). High schools students devote even less time (10%) to discovery learning and problem solving and concentrate on programming (49%) and a combined word processing and drill and practice (36%) (CSOS, 1986, p.5). Results from Australian studies suggest similar patterns (Fitzgerald et al, 1986) (Fasano et al., 1987).

The evidence and arguments outlined in this sections suggests that the differential speeds of developments observed in education might have been produced by a number of factors. Some of them are legitimate. They are the genuine economic needs and pedagogical expectations, the need for industrial restructuring, the need for more cost/efficiency in the public sector. These elements have combined to operate in a climate of scarce resources and scarce information, where little was known and all had to be explored as to the real potential of the technology for education.

Next to these elements one could guess other less legitimate ones. They are the need of the Australian industries and business sector to shift on to other areas their responsibilites for lack of the knowledge and skills needed to meet the international economic challenge. As was the case with youth unemployment in the 70s, problems that start being essentially economical could end being problems mainly for education and of education (Fasano, 1983). Forcing on to education a change "from above" which aims at changing structures as well as content could also conceal the need to "spring clean" industrial relations in education. Some of the recent moves in some Australian states to introduce "merit" criteria to replace "seniority" in the teaching career are indicative of this state of affairs. Finally, the technology could be used as an alibi to promote policy changes which fit uneasily within a traditionally labour political platform but are instrumental in winning support from non labour quarters.

Whatever the reasons, legitimate or less so, the "technology" pressures have been high on education for some years and are likely to continue. The question then arises whether education can afford to persist in its coping strategy - mainly one of responding so far - or whether the time has come for education to take a more proactive view and force the pressures to take education where education <u>wants</u> to be.

Part III From reaction to proaction ?

A shift from reaction to proaction will not happen easily in education. Still, the steps to be taken are not necessarily out of reach for the institution.

One step would be to establish an independent diagnosis of the "needs of the economy" and subsequently clarify how responsibilities should be allocated between industry and business, education and other government agencies. An essential part of the diagnosis could be the clarification of the role and function of education in the technology market, as a consumer as well as a producer. In particular, it would be useful to review the place of education in the equation linking trained (and educated) manpower to financial returns to the economy.

Finally, in considering the current policies pressed on to education because of the "needs of the economy" it would be useful to distinguish between "emergency" measure and "maintenance" ones, between policies to increase capacity without changing the structures and those aiming at altering the institution on a permanent basis. On the basis of such understanding, education could take informed decisions about its own agenda, to support some of the current demands, to reject others and to formulate different ones for itself at the macrolevel.

Another step would involve the development of policies to deal with the differential patterns of development in education, knowing that in the absence of such policies the gaps would grow only wider. In particular there is a need to look specifically at the two quite separate sectors that have developed: the large scale one and the "experimental" one, each carrying its own set of demands on policy makers. At the macrolevel, investments have focussed on equipment, software and, at best, curriculum development. They have been lesser in teacher training and exceedingly marginal in evaluating the impact of technology on a number of important aspects of education, such as learning processes, costs, organisational structures, and industrial issues.

At the level of innovations, resources tend to be discontinuous and life time of programmes short. Furthermore in-depth evaluation studies remain wanting.

On the research front, while there is no denying the merit of exploring "the potential of the technology" for learning, there is the need to concentrate on those areas that are more relevant to the ordinary classroom and produce the kind of knowledge and guidance that teachers can more easily use in their ordinary environment to enrich it. Resources are also needed to make such information available to the teachers.

On the institutional front, two areas qualify for attention. One relates to the coordination of technology development across educational levels - who is supposed to do what - so that objective and investments are rationalised both vertically and horizontally. More investments in primary education would perhaps ease the "literacy" obligations on secondary and tertiary levels. Better coordination between post-compulsory provisions could perhaps pool resources across schools and TAFE to the benefit of the students in both. Similar arguments would apply to colleges and universities.

The other institutional area deserving attention is what could be called loosely "distance learning". Computer-based telecommunication has entered education only recently and is showing promise, although for the time being, at a high financial cost.

Trends in the technology market show that this sector is growing at a faster rate than the others. The implications for society as a whole are considerable. They impinge on the work habits, on the way people live. Education has not escaped the growth of microcomputers. It is unlikely that it will be able to ignore this new development.

As habits change, education might well be called to develop a different model of delivering its service, based on learning at a distance, at least from the teacher if not from the educational establishments themselves. The need might not be there for some time for urban schools and urban children, but it has been there for a long time in country areas. Reasons of "equity" suggests increased investments in this area of education to gain experience which will prove invaluable in the future, for the whole institution as well as for all its clients.

The arguments developed in this paper have spanned a large array of issues, from technical to institutional and pedagogical. Amidst these there have been others on visible policies and hidden objectives. In each case, it would not be hard to recognise the underlying theme: the discourse on technology in education is very close to being a political one.

Fundamentally, the discourse about technology in education is a discourse about values and ideology, about power and control, about responsibility and accountability; a discourse about institutions and corporations.

This is, for the time being, somewhat removed from the concerns of this conference, from the dynamics of learning and of becoming a learning society. Yet, the picture drawn in this paper is essential for education to note to make sure that the outcomes of the past and present developments will be phrased differently in the future - not in terms of politics but in terms of learning. To achieve this, education needs to be proactive, not reactive.

By being proactive, by establishing its own diagnosis and agendas, by doing its own springcleaning without any outside prompting, by anticipating technological trends instead of (sometimes) succumbing to them, education will be able to develop another discourse, one closer to the raison d'etre of education. That is a discourse about minds, about individual minds, about their creativity, curiosity and, especially, about their ability to be judicious.

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